

27. A system for producing foamed material comprising:

an extruder having an inlet for receiving a precursor of a foamed material at an inlet end thereof, an outlet at an outlet end thereof for releasing foamed material from the extruder, and an enclosed passageway connecting the inlet with the outlet constructed and arranged to contain a product of a mixture of a blowing agent that is essentially entirely a supercritical fluid and molten material to be foamed and to maintain the product above the critical temperature and pressure of the supercritical fluid therein;

a nucleator associated with the passageway capable of nucleating the product in the passageway in the absence of an auxiliary nucleating agent; and

an orifice between the inlet and the outlet, fluidly connectable to a source of blowing agent arranged such that the blowing agent, admixed with molten material in the extruder, can be maintained in a supercritical state in the extruder and mixed with the molten material in the extruder to form the product.

claim
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parent
but
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fluid
to blow
agent

28. A system as in claim 27, wherein the orifice is connectable to a source of a blowing agent comprising carbon dioxide.

29. A system as in claim 27, wherein the orifice is connectable to a source of a blowing agent comprising supercritical carbon dioxide.

30. A system as in claim 27, wherein the orifice is connectable to a source of a blowing agent consisting of supercritical carbon dioxide.

31. A system as in claim 27, wherein the orifice is connectable to a source of a blowing agent comprising a supercritical fluid.

32. A system as in claim 27, wherein the nucleator is capable of nucleating the product at a rate sufficient to produce microcellular polymeric material.

33. A system as in claim 27, wherein the extruder is constructed and arranged to form a single-phase solution of molten polymer material and blowing agent in the passageway.

34. A system as in claim 27, wherein the nucleator is capable of nucleating the solution of molten material and blowing agent by subjecting the solution to a rapid pressure drop.

35. A system as in claim 27, wherein the nucleator comprises a sheet die.

36. A system as in claim 27, further comprising a molding chamber downstream of the nucleator.

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37. A system as in claim 27, wherein the orifice is in the vicinity of a mixing section of a polymer processing screw.

38. A system as in claim 27, wherein the extruder includes a screw mounted within a barrel and the enclosed passageway is defined, in part, between the screw and the barrel.

39. A system for producing foamed material, comprising:
an extruder having an enclosed passageway connecting an inlet at an inlet end thereof designed to receive a precursor of microcellular foamed material and an outlet at an outlet end thereof designed to release a nucleated solution of a blowing agent and a polymeric material,
the enclosed passageway constructed and arranged to form a single-phase solution of blowing agent and polymeric material, to contain the solution in a fluid state at an elevated pressure within the passageway, and to advance the solution as a fluid stream within the passageway in a downstream direction, and further including a

nucleating pathway for creating a nucleated solution of the polymeric material and the blowing agent, and

a molding chamber connected to the outlet end, constructed and arranged to receive a nucleated solution of blowing agent and polymeric material released from the outlet end.

40. A system as in claim 39, wherein the nucleating pathway creates a nucleated solution of the blowing agent and polymeric material by subjecting the solution to a rapid pressure drop.

41. A system as in claim 39, wherein the blowing agent comprises carbon dioxide.

42. A system as in claim 39, wherein the blowing agent comprises essentially completely carbon dioxide.

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43. A system as in claim 39, wherein the nucleating pathway includes a polymer receiving end constructed and arranged to receive a non-nucleated homogeneous fluid, single-phase solution of a polymeric material and a blowing agent, a nucleated polymer releasing end constructed and arranged to release nucleated polymeric material, and a fluid pathway connecting the receiving end to the releasing end.

44. A system as in claim 39, further comprising an orifice between the inlet and the outlet of the enclosed passageway fluidly connectable to a source of blowing agent.

45. A system as in claim 44, wherein the orifice is in the vicinity of a mixing section of a polymer processing screw.

46. A system as in claim 39, wherein the extruder includes a screw mounted within a barrel and the enclosed passageway is defined, in part, between the screw and the barrel.

47. A system as in claim 39, wherein the nucleator is capable of nucleating the product at a rate sufficient to produce microcellular polymeric material.